

## FY 2020 Competition Information Sheet

### Program Name

Modeling, Analysis, Predictions, and Projections (MAPP) Program.

### Program Mission

The mission of the Modeling, Analysis, Predictions, and Projections (MAPP) Program is to enhance the Nation's capability to predict variability and change in Earth's climate system. The MAPP Program focuses on the coupling, integration, and application of Earth System models and analyses across NOAA, among partner agencies, and with the external research community. Primary objectives include: 1) improving Earth System models; 2) supporting an integrated Earth System analysis capability; 3) improving methodologies for global to regional scale analysis, predictions, and projections; and 4) developing integrated assessment and prediction capabilities relevant to decision makers based on climate analyses, predictions, and projections. The MAPP Program sits within the Earth System Science and Modeling (ESSM) Division of the NOAA Office of Oceanic and Atmospheric Research (OAR) Climate Program Office (CPO).

### Focus for FY20

#### **Constraining Models' Climate Sensitivity**

Proposals may target only one of the FY 2020 MAPP competitions, which must be clearly identified in the proposal summary.

### Funding for FY20

Pending the availability of funds in FY 2020, the MAPP program anticipates a funding allocation of \$1,800,000 for this competition. Total funding for this competition may exceed this amount, depending on partners' contributions.

Proposals may be for up to three years, up to \$170,000/year per Type I projects and up to \$500,000/year for the Type II project (only one Type II project may be funded). A total of 7-10 projects may be funded; this number may be exceeded depending on partners contributions. The MAPP program may partner with other U.S. Global Change Research Program agency partners to fund awards from this competition.

### Competition Information

#### **Title: Constraining Models' Climate Sensitivity**

The response of Earth's climate to projected continuing increases in the concentrations of atmospheric greenhouse gases (GHGs; primarily anthropogenically-generated carbon dioxide and methane) will be

global temperature increases due to changes in the Earth's radiation balance (radiative forcing)<sup>1,2</sup>. While this response is unequivocal, there is still significant uncertainty on the exact amplitude of the globally-averaged temperature increase in response to changes in radiative forcing or the so-called climate sensitivity. This also impacts the regional level, for example the U.S. projections that are the basis for the National Climate Assessment<sup>3</sup>. Besides uncertainties in future GHG concentrations, there is model uncertainty on the warming generated by specified concentrations of GHGs and aerosols, among the many atmospheric constituents<sup>4</sup>. For example, the equilibrium change in global mean near-surface air temperature that would result from a sustained doubling of the atmospheric carbon dioxide (or equilibrium climate sensitivity) as estimated based on the Coupled Model Intercomparison Project - Phase 5 (CMIP5) model simulations is likely in the range 1.5 - 4.5°C<sup>5</sup>, with an even larger spread if we consider less likely values. Initial results from the next generation models (CMIP6) seem to indicate that this range is at best not decreasing<sup>6</sup>.

Because future warming is a critical factor affecting climate projections (e.g. precipitation, extremes, sea level, sea ice, etc.) globally and specifically in the U.S., it is critical to reduce the uncertainty in climate model sensitivity estimates. These model uncertainties largely arise from feedback processes which may amplify or diminish the effect of direct radiative forcing from increasing GHGs and contribute to determine climate sensitivity. Particularly large are the uncertainties associated with how clouds and convection will change with warmer conditions, and the feedback processes that will come into play. The radiative forcing associated with atmospheric aerosols and their interactions with radiation and clouds are also uncertain<sup>4</sup>. Depending on the timescales under consideration, the above atmospheric processes underpinning uncertainties in climate sensitivity in turn couple with ocean heat uptake processes and feedbacks e.g. changes in sea-ice and the thermohaline circulation, which also contribute to climate sensitivity.

In FY 2020, the OAR/Climate Program Office (CPO) MAPP Program solicits research investigations to constrain climate model sensitivity focusing on clouds, convection and aerosol processes and their role within the coupled Earth system, with the goal of reducing overall uncertainties in future climate projections.

Proposals can focus on one or more of the Priority Areas A-C below:

- A. Assess climate model sensitivity and uncertainties associated with clouds, convection and aerosols in CMIP6 generation models. To this end, develop new/improved methodologies and integrate new understanding and data to improve our understanding and assessment of climate sensitivity, explaining differences in sensitivities among models and generations of models.
- B. Define key process-level metrics/diagnostics using relevant observations to accelerate the improvement of models' representation of processes as in Priority A. To this end proposers are encouraged to leverage the process-level diagnostics approach and framework of the MAPP Model Diagnostic Task Force<sup>7</sup> and contribute new metrics to the software framework.
- C. Use observations to develop direct and indirect constraints on models' climate sensitivity and apply them to reduce model projections' uncertainty focusing on temperature projections.

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<sup>1</sup> IPCC AR5 Chapter 10: [http://www.climatechange2013.org/images/report/WG1AR5\\_Chapter10\\_FINAL.pdf](http://www.climatechange2013.org/images/report/WG1AR5_Chapter10_FINAL.pdf)

<sup>2</sup> Fourth National Climate Assessment: <https://nca2018.globalchange.gov/>

<sup>3</sup> <https://nca2018.globalchange.gov/>

<sup>4</sup> IPCC AR5 Chapter 8 [http://www.climatechange2013.org/images/report/WG1AR5\\_Chapter08\\_FINAL.pdf](http://www.climatechange2013.org/images/report/WG1AR5_Chapter08_FINAL.pdf)

<sup>5</sup> Bindoff, Nathaniel L.; Stott, Peter A. (2013). "10.8.2 Constraints on Long-Term Climate Change and the Equilibrium Climate Sensitivity" (PDF). *Climate Change 2013: The Physical Science Basis - IPCC Working Group I Contribution to AR5*. Geneva, Switzerland: [Intergovernmental Panel on Climate Change](http://www.climatechange2013.org/images/report/WG1AR5_Chapter08_FINAL.pdf).

<sup>6</sup> <https://www.wcrp-climate.org/news/wcrp-news/1478-cmip6-first-results>

<sup>7</sup> <http://bit.do/NOAA-ESSM-MAPP-Model-Diagnostics-Task-Force>

Across Priority Areas A-C above, proposals must:

- Ensure proposed modeling work adequately leverages observational data to constrain models. This includes the use of historical in situ observations, field campaign data, satellite data. Proposers will pay particular attention to the optimal use of data from NOAA Research Laboratories and other NOAA entities. Proposers should demonstrate the availability and suitability of the data for proposed research.
- Complement and extend research done within NOAA Research Laboratories, including key collaborations in the proposals, as appropriate.
- Leverage existing relevant model datasets available from the Coupled Modeling Intercomparison - Phase 6 (CMIP6) and/or hindcast experiments; may also propose experiments as justified by proposed research goals.

Across Priority Areas A-C above, proposals may consider:

- High profile-well documented historical cases, field campaigns or natural analogs of future change, either past or on-going, in a broader statistical context.
- Exploratory use of artificial intelligence methodologies to examine/synthesize/emulate observational/model behavior, ensuring approaches are supplemented by physical understanding.

Proposals may be for two types of projects:

- Type I Projects will address one or more of Priority Areas A-C and will contribute with their project to MAPP Task Force activities (above).
- Type II Project (only one will be funded) will have the same scientific objectives as Type I Projects, will address at least two Priority Areas A-C, and will also lead and coordinate the planned MAPP Task Force. Type II proposals should clearly separate scientific tasks and Task Force leadership/coordination activities, detailing plans and costs for each. The goal of the proposed leadership/coordination activities will be to integrate research from Type I proposals to optimize the outcomes of this research initiative. This will include facilitating the exchange of information/practices among Investigators; synthesis of new results and methodologies (e.g. special journal collections, topical reports, workshops); communication with relevant external entities; and demonstrating how research projects yield results that will feedback to accelerate development of NOAA climate model development and reduce uncertainties in the National Climate Assessment.

MAPP Competition Manager: Annarita Mariotti ([Annarita.mariotti@noaa.gov](mailto:Annarita.mariotti@noaa.gov))

#### **Additional General Guidelines for Applicants**

- Principal Investigators submitting a proposal in response to this MAPP Announcement are required to follow the Letters of Intent (LOI) and Proposal preparation and submission guidelines described in the Climate Program Office FY 2020 Federal Funding Opportunity announcement.
- Investigators are strongly encouraged to submit an LOI prior to developing and submitting a full proposal using the [FY20 MAPP Letter of Intent submission form](#)<sup>8</sup>; investigators unable to submit via the form should email their LOI to [oar.cpo.mapp@noaa.gov](mailto:oar.cpo.mapp@noaa.gov). Investigators will be notified by

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<sup>8</sup> Note, a Google account is needed to submit via this LOI submission form:  
<https://forms.gle/y7T8Zuev42BDh2zY8>

the MAPP Program Competition Manager as to whether a full proposal is encouraged based on the LOI within 30 days of the LOI due date.

- Proposals must clearly identify in their summary which MAPP competition is being targeted (only one competition may be targeted by a given proposal) and which sub-element of the competition is being targeted, if applicable.
- Administrative questions regarding the Federal Funding Opportunity (e.g. proposal formatting or submission guidelines) should be directed to Diane Brown ([diane.brown@noaa.gov](mailto:diane.brown@noaa.gov)).

A webinar will be offered to potential applicants for background on the MAPP program and this solicitation soon after publication of this announcement. For information on webinar timing and registration procedures please check the MAPP website<sup>9</sup>; prior to when the webinar is held, potential applicants can also [sign-up](#) to receive an email notification<sup>10</sup>.

## Data Archiving and Computational Resources

### Computational Resources

Computational resources on NOAA's high-performance computing platforms may be requested for research sponsored as a result of this solicitation. Proposals should indicate the availability of alternative computing resources should NOAA resources not be available for the project. Proposers who choose to request computational allocations on NOAA's platforms must include in their proposal a request describing the computational resources and data storage required, as well as a description of how they will port their methodology to the NOAA platforms. Proposers must submit an [HPC Request Form](#) with their proposal in order to apply for computational resources<sup>11</sup>.

Questions regarding the use of NOAA's high-performance computing platforms should be directed to Dan Barrie (<mailto:daniel.barrie@noaa.gov>).

### Data Management Guidance

The MAPP Program requires that all products and deliverables produced via solicitation will reside in the open access / open source domain, freely available to the public.

Public access to grant/contract-produced data will be enabled in one of the following ways (select one):

- Funding recipients are planning to submit data to NOAA National Centers for Environmental Information (NCEI), which will provide public access and archiving<sup>12</sup>. Point of Contact for NCEI is Nancy Ritchey ([Nancy.Ritchey@noaa.gov](mailto:Nancy.Ritchey@noaa.gov))
- Data are to be submitted to the International Council for Science (ICSU) World Data System facility: <https://www.icsu-wds.org/community/membership/regular-members>)
- An existing publicly accessible online data server at the funded institution is to be used to host these data (describe in proposal).

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<sup>9</sup> MAPP website: <https://cpo.noaa.gov/MAPP>

<sup>10</sup> MAPP Webinar sign up prior to when the webinar is held:  
<https://docs.google.com/forms/d/e/1FAIpQLScoswYBrwTxvjNseONZ5HD3MEP8ggbg8yPN19gdEVp3WTYdbUA/viewform>

<sup>11</sup> [HPC Request Form](#)

<sup>12</sup> NCEI supports the creation of adequate metadata and data ingest into long term repository holdings using tools such as Send2NCEI ([www.nodc.noaa.gov/s2n](http://www.nodc.noaa.gov/s2n)), for small volume, one-time only data collections) and Advanced Tracking and Resource tool for Archive Collections or ATRAC ([www.ncdc.noaa.gov/atrac](http://www.ncdc.noaa.gov/atrac)), for recurring and/or large volume data collections).

- An existing publicly accessible online “cloud” service is to be used to host the data (described in the proposal).

The Competition Manager (above) is the responsible NOAA Official for questions regarding this guidance and for verifying accessibility of data produced by funding recipients.